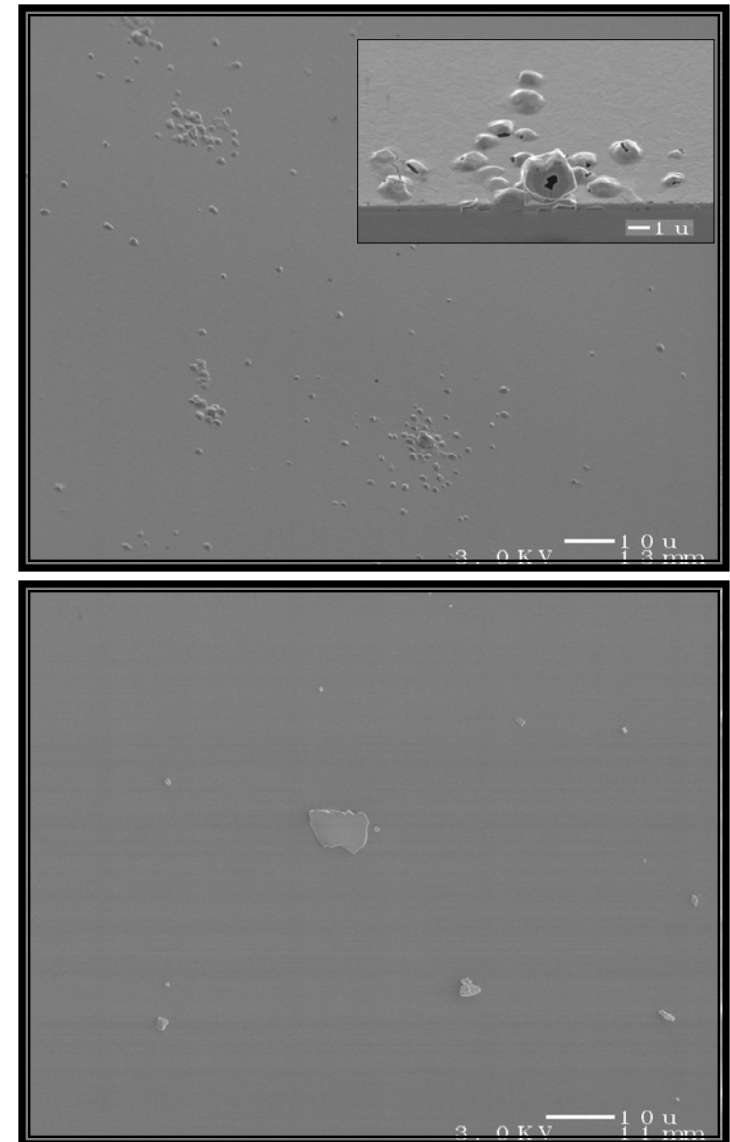


Generation of a Pristine Sapphire Surface by Oxidation and Solid State Conversion of a Sputtered Al Coating

H.M. Chan, R.P. Vinci, Lehigh University, DMR-0211078

- Sapphire substrates (Al_2O_3) are used for applications in which quality of the final surface finish is critical.
- Examples: blue light emitting diodes and laser diodes, visible and midwave infrared airborne windows and radomes for guidance systems.
- Currently, the surfaces of sapphire components are finished by a combination of costly mechanical and chemical polishing.
- We are developing an alternative, potentially more cost-effective method (the AGOG process).
- The process is based on deposition of an aluminum thin film followed by high temperature conversion of the film to single crystal sapphire.
- Successes thus far include development of a method for eliminating the formation of undesirable hillocks (surface bumps) by anodizing the aluminum prior to heat treatment.
- Currently we are optimizing the thin film deposition that forms the first step of the process. Small variations in processing can lead to an unsuccessful process but the causes are not yet understood.



Top: Surface of heat treated film showing hillock clusters. Bottom: Pre-anodized surface is smooth; only dust is visible.



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Broader Impact:

- AGOG process used to produce nano-patterned sapphire substrates, which have the potential to reduce the defect density of GaN epitaxial films.
- The AGOG process was a featured case study in an undergraduate thermo-dynamics class.
- Served as a judge at the Lehigh Valley Science Fair in March (RPV).
- The group presented a poster at an Open House for the Center of Optical Technologies at Lehigh. The purpose of the event was both to familiarize local optoelectronics companies with Lehigh's capabilities and activities in this area, and promote collaborations.
- 2003 Teaching Award: R.P. Vinci received the Gilbert E. Doan Award, awarded by graduating seniors

